Amendments to the Claims

The following listing of claims replaces all prior listings, and all prior versions, of claims in the application.

Listing of Claims

1. (currently amended) A surface processing method of a sample having a metal of high melting point or multilayer film comprising at least metal of high melting point and semiconductor deposited on a substrate, ~~the method~~ comprising steps of:

installing said sample on a sample board in a vacuum container,

generating a plasma of a gas containing at least halogen atom inside said vacuum container,

applying a radio frequency bias voltage ~~having a frequency ranging from 200 kHz to 20 MHz~~ on said sample board, and

controlling a periodic on-off the radio frequency bias voltage with an on-off control frequency ranging from 100 Hz to 10 kHz,

wherein said gas is mixed gas consisting of at least a gas containing fluorine atom and a gas containing oxygen atom, and said sample is treated by said plasma.

2. - 4. (cancelled)

5. (currently amended) A surface processing method according to Claim [[4]]1, wherein said sample to be treated is maintained at the temperature not exceeding 20 degrees Celsius.

6. (currently amended) A surface processing method according to Claim 1, wherein said ~~multilayer film of said~~ sample to be treated is ~~formed by~~ a lamination of at least metal of tungsten film and semiconductor of polycrystalline silicon film.

7. (original) A surface processing method according to Claim 6, further characterized in that tungsten nitride or titanium nitride film is provided between said tungsten film and polycrystalline silicon film.

8. (original) A surface processing method according to Claim 1, further characterized in that a mask without containing carbon as major component is formed on said metallic film.

9. (new) A surface processing method according to Claim 1, wherein said processing step is divided into steps, and the net power of the radio frequency power applied to said sample is reduced at least in the last step.

10. (new) A surface processing method according to Claim 1, wherein frequency for cyclic on-off control of said radio frequency voltage ranges from 100 Hz to 10 kHz.

11. (new) A surface processing method according to Claim 1, wherein the percentage of on-period accounts for 5 to 60% in a cycle of on-off control of said radio frequency voltage.

12. (new) A surface processing method according to Claim 1, wherein said radio frequency bias voltage applied has a frequency ranging from 20 kHz to 20 MHz.

13. (new) A surface processing method wherein a sample where a mask layer without containing carbon as a major component formed on the substance to be processed is laid on a sample board in a vacuum container, plasma is generated inside said vacuum container, radio frequency bias voltage is applied on said sample board, and plasma treatment is provided by periodic on-off control of radio frequency bias voltage applied on said sample board, wherein:

said plasma consists of a mixture of halogen gas and adhesive gas, and

said halogen gas is a mixed gas of chlorine and BCl_3.

14. (new) A surface processing method according to Claim 13, wherein said adhesive gas is a carbon hydride.

15. (new) A surface processing method according to Claim 14, wherein said carbon hydride is selected from the group consisting of methane, ethane and propane.

16. (new) A surface processing method according to Claim 13, wherein said adhesive gas is gas prepared by diluting a carbon hydride with a noble gas.

17. (new) A surface processing method according to Claim 16, wherein said carbon hydride is selected from the group consisting of methane, ethane and propane, and said noble gas is argon.

18. (new) A surface processing method according to Claim 13, wherein said adhesive gas mixed with said halogen is nitrogen gas or gas including nitrogen atom.

19. (new) A surface processing method according to Claim 13, wherein the method of making intermittent the bias voltage applied to said sample is characterized in that the percentage of on-period accounts for 5 to 60% in a cycle of on-off control of said radio frequency voltage.

20. (new) A surface processing method according to Claim 13, wherein the mixing rate of the adhesive gas to be mixed with said halogen gas ranges from 0.5% to 50%.

21. (new) A surface processing method of a sample comprising multilayer film of n-type polycrystalline silicon and p-type polycrystalline silicon laminated on an oxide film, comprising steps of:

installing said sample on a sample board in a vacuum container;

generating a plasma of a gas inside said vacuum container;

applying a radio frequency bias voltage on said sample board; and

treating said sample by said plasma, said treating including etching, wherein the etching includes:

etching said n-type polycrystalline silicon and said p-type polycrystalline silicon by introducing mixed gas containing fluorine and oxygen into said vacuum container while applying periodically on-off controlled radio frequency bias voltage, and

after exposing of said oxide film, continuously etching by changing said etching gas into mixed gas containing hydrogen bromide and oxygen, and changing said radio frequency voltage into continuous application.

22. (new) A surface processing method of a sample comprising multilayer film of polycrystalline silicon laminated on an oxide film and metal film laminated on the polycrystalline silicon film, comprising steps of:

installing said sample on a sample board in a vacuum container;

generating a plasma of a gas inside said vacuum container;

applying a radio frequency bias voltage on said sample board; and

treating said sample by said plasma, said treating including etching, wherein the etching includes:

etching said metal film by introducing mixed gas containing fluorine and oxygen into said vacuum container while applying said radio frequency bias voltage continuously,

etching said polycrystalline silicon by introducing mixed gas containing fluorine and oxygen into said vacuum container while applying periodically on-off controlled radio frequency bias voltage, and

after exposing of said oxide film, continuously etching by changing said etching gas into mixed gas containing hydrogen bromide and oxygen, and changing said radio frequency voltage into continuous application.